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ABSTRACT

This paper presents a model of how the supply of applicants for public employment programs may be determined, with the information necessary to incorporate the model factors into simulation of such programs. The methodology used to estimate the size and composition of the supply population for public employment programs--how many persons would have preferred public employment had that option been available to them--is outlined. The availability of jobs in a given public employment program, as well as the potential labor supply, is considered. The supply of applicants is positively related to wage differences but negatively related to differences in hours. Changes in public policy both in and out of the manpower area may also influence the supply of applicants. The methodology employed in this research is sufficiently flexible for adoption to various program characteristics. (MF)

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ESTIMATING THE SUPPLY POPULATION FOR PUBLIC EMPLOYMENT PROGRAMS

David H. Greenberg

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ESTIMATING THE SUPPLY POPULATION FOR PUBLIC EMPLOYMENT PROGRAMS[1]

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I. INTRODUCTION

Recent approval by Congress of the Emergency Employment Act of 1971 once again raises important but usually ignored questions about the potential supply of applicants for public employment programs. For example, are the number of persons who would like to enroll in a given public employment program roughly in balance with the number of slots available? If the supply of applicants is excessive, how can the available slots be appropriately rationed? If there are not enough applicants, could the stipend paid under the program be increased or the program in some other way be made more attractive?

The supply of applicants has an important qualitative, as well as quantitative, dimension. Knowledge of both the number and the composition of the supply under various conditions is necessary. For example, is the supply of those whom policymakers feel can most benefit from the program sufficiently large? At how high a stipend will a sufficient number of applicants having qualities desired by program administrators

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enroll? To attract a sufficient number of "desirable" applicants, must the absolute number of applicants be permitted to exceed the number of available training positions? As greater effort is made to impart marketable skills rather than simply providing stopgap jobs, how does the number and composition of trainees change?

Proposed changes in public policy outside the manpower area may also influence the supply of applicants. For example, if some version of the Administration's Family Assistance Plan is finally implemented, what will be the effect on the supply population?

To begin answering such questions as those posed above, I attempt in this paper to outline a practical methodology that can be used to estimate the size and composition of the supply populations for various public employment programs. I am hopeful that, in addition to providing usable tools for empirical analysis, the development of such a methodology will help to illuminate some of the issues associated with public employment. I also try, when feasible, to suggest data sources and to indicate reasonable ranges of values for the program and behavioral parameters.

The methodology is hopefully sufficiently flexible so that adoption to various assumptions about program characteristics and behavioral parameters is easy and obvious. For illustrative purposes some of the discussion will reference the 1967 Survey of Economic Opportunity, a data set which incorporates the information necessary to implement the methodology and with which I have considerable familiarity. Using the methods presented in this paper and the 1967 Survey of Economic Opportunity,

a researcher can estimate how many persons would have preferred employment in a given public employment program in 1966, had that option been available to them.

II. A SIMPLE MODEL OF THE SUPPLY OF APPLICANTS FOR PUBLIC EMPLOYMENT PROGRAMS

In this section I present a very simple model of how the supply of applicants for public employment programs is determined. While the model is too general to be directly applied to empirical supply estimations, it does introduce the factors which need to be considered. In the following sections of this paper, I shall attempt to provide the information necessary to incorporate these factors into simulations of specific public employment programs.

Governmental agencies that participate in public employment programs are usefully viewed as oligopsonistic buyers of labor. It is most likely, although not necessarily the case, that the labor purchased will be of low productivity. Like more conventional employers, public employers may tap three sources of supply: (1) the employed, (2) the unemployed, and (3) those outside the labor force. Each of these groups will be treated separately.

In the most general terms, the supply of program applicants, S_p, at a particular point in time is determined by a comparison each potential applicant makes between the program and other available opportunities. This comparison may be represented by the following function:

$$S_p = f[(Y_p - Y_c), (H_p - H_c), V_p], \tag{1}$$

where $\partial S_p/\partial(Y_p - Y_c) > 0$, $\partial S_p/\partial(H_p - H_c) < 0$ and $\partial S_p \partial V_p > 0$ and where Y_p and H_p are, respectively, the present value of the income stream

and the hours of work associated with public employment, Y_c and H_c are the present value of the income stream and hours associated with the best alternative opportunity available to each potential applicant, and V_p represents program visibility.

Since the supply of applicants is positively related to differences between the present value of the income flow from public employment and that from alternative opportunities, but negatively related to differences in hours, a trade-off between hours and income is implied. Two additional implications of equation (1) also need emphasis. First, the equation suggests that income and hours should be appropriately discounted over each potential applicant's planning horizon. Any empirical results are likely to be sensitive to whatever assumptions are made about the appropriate length of this period.

Second, in a frictionless economy, an individual would be expected to join public employment whenever the combination of income and hours associated with the program are <u>marginally</u> superior to those associated with alternative opportunities. While most of the analysis in this paper rests on an implicit assumption that individuals do behave in such a way, it should be recognized that in actual practice a substantial differential between public and more conventional employment may be necessary, if only to overcome inertia. Over the long run, however, many of the frictions which do exist in the real world would be overcome. For example, many persons may not actively consider voluntarily leaving their present job in order to participate in public employment; but once they have been terminated by their present employer, public employment

may be considered a viable alternative to a new job within the conventional sector. Thus the methodology presented in this paper is best viewed as being based on a static model of economic behavior; the adjustments to the introduction of a public employment program which are implied would not take place instantaneously, but only over time. The larger the comparative advantage of public employment, the more rapidly the adjustments would be expected to occur.

During a particular time period, t, the income received by an employee from his work effort is a product of the net hourly wage, W^t, and hours worked, H^t. That is,

$$Y^t = W^t \cdot H^t. \tag{2}$$

Note that in equation (2) and throughout this paper, wages are defined in net rather than in gross terms. In other words, remuneration for an hour's work is conceived as incorporating other pertinent working conditions in addition to direct cash payments made by an employer. Thus,

$$W^t = \overline{W}^t - T^t - B^t - C^t + E^t - R^t - S^t, \tag{3}$$

where $\overline{W}$ is nominal money wages, T is the tax paid on each hour of work, B represents the average hourly transportation or moving costs associated with getting to the job, C is other work-related expenses such as child care, E is the present value of the human capital accrued during the hour, R is a risk premium paid if the job is perceived as particularly insecure, and S is a "status" premium paid if the job is perceived as having a particularly poor image. Each of these wage components will be discussed separately in later sections.

While equation (3) is applicable to both conventional employers and public employers, there are crucial differences in the way net wages are actually determined. W_p^t, the public employment wage rate, is essentially determined by various policy decisions on the part of those who establish and those who operate the program. Thus, the components of W_p^t may be viewed as policy parameters. W_c^t, the wage rate offered by conventional employers, on the other hand, is more or less sensitive to conditions in the labor market. Particularly important in the context of the model is the possibility that a public employment program may force conventional employers to increase their wages to prevent their employees from being bid away. Thus,

$$W_c^t = g(S_p^t) \quad \text{when} \quad S_p^t \leq D_p^t \tag{4a}$$

or

$$W_c^t = h(D_p^t) \quad \text{when} \quad S_p^t > D_p^t, \tag{4b}$$

where $\partial W_c^t/\partial S_p^t > 0$ and $\partial W_c^t/\partial D_p^t > 0$ and where D_p^t is the number of available program slots.

In principle, employers may respond to a bidding away of their employees by adjusting hours as well as wages. Such adjustments, however, seem unlikely to substantially influence the size of the supply population for public employment. For this reason I will assume throughout this paper that H_c, the hours of work associated with jobs in the private sector, is exogenously determined.

Hours of work in a public employment program, H_p, is likely to be treated by program administrators as a policy parameter. In principle,

each program participant could be allowed to work as many hours as he desired. In this case,

$$H_p = k(W_p). \tag{5}$$

As a practical matter, however, some restrictions on hours would probably be imposed. For example, the program could probably be more easily administered if participants were all required to work the same number of hours per week. Other potential constraints involve program requirements that a person be unemployed for some minimum period before entering the program or that a person must leave the program after some maximum number of weeks.

Another determinant of S_p is program visibility, V_p. Unless persons are aware of the program and know something about it, public employment is not a viable alternative for them, and no wage and hours comparisons will take place. Visibility is likely to be positively related to the publicity given the program, the length of time the program has been in operation and the size of the program. Throughout this paper, I shall assume that all potential applicants have sufficient information to make the income and hour comparisons implied by equation (1).

III. THE EMPLOYED

In this section, I attempt to develop a practical methodology for estimating the number of workers who are employed within the conventional sector for the number of hours they wish to work, but who nevertheless would participate in a public employment program.

The Income Comparison

Equation (1) implies that the decision of whether or not to apply for a public employment position depends upon two comparisons between public employment and the individual's best alternative. The first comparison is based on income received and the second on hours expended. I temporarily ignore the latter in order to concentrate on the former. To further clarify the exposition, I assume that the demand by conventional employers for potential program applicants is perfectly elastic and that, prior to the introduction of a public employment program, all potential applicants are in hours equilibrium (that is, they are working the number of hours they wish to work). These restrictions will be modified in later sections.

If one ignores hours, determination of whether a particular worker would elect to participate in a given public employment program is rather straightforward. All that is necessary is to compare the present value of the future earnings the worker would expect if he joined the program with that he would expect if he did not. If $Y_p > Y_c$, he would select public employment over his present job.

The expected future income stream associated with either public employment or the worker's best alternative may be estimated as follows:

$$Y = \frac{W^1H^1}{(1+r)} + \frac{W^2H^2}{(1+r)^2} + \ldots + \frac{W^jH^j}{(1+r)^j} + \ldots + \frac{W^nH^n}{(1+r)^n}, \qquad (6)$$

where t=1, 2, ... j, ... n and where n is the number of periods (i.e., years) in the worker's planning horizon and r is the worker's discount rate. Thus, the inequality, $Y_c < Y_p$, may be usefully expressed as

$$\frac{W_c^1H_c^1}{(1+r)} + \frac{W_c^2H_c^2}{(1+r)^2} + \ldots + \frac{W_c^nH_c^n}{(1+r)^n} < \frac{W_p^1H_p^1}{(1+r)^1} + \frac{W_p^2H_p^2}{(1+r)^2} + \ldots + \frac{W_p^nH_p^n}{(1+r)^n} \qquad (7)$$

It is clear from (7) that before the simulation can proceed values must be assigned to r, n, and, for each year within the planning horizon, to W_c^t, H_c^t, W_p^t, and H_p^t.

W_p^t and H_p^t are the major public employment program policy variables and will be discussed later in some detail. The only point that needs to be made here about these two variables is that, with one exception, they are assumed to remain unchanged over the planning horizon. This assumption is made for notational convenience. It is easy to envision alternative assumptions; the program money wage, for example, could be made a positive function of length of time in the program. At the loss of some simplicity, the methodology could be adopted to such alternatives. The exception to the assumption concerns H_p^1, hours during the first year on the program. By not constraining H_p^1 to equal program hours during other years, analysis is facilitated of a possible provision requiring a minimum period of unemployment before entry to the program. The assumption about W_p^t and H_p^t is expressed algebraically as

$$W_p^1 = W_p^2 = \ldots = W_p^j = \ldots = W_p^n \tag{8}$$

and

$$H_p^2 = H_p^3 = \ldots = H_p^j = \ldots = H_p^n. \tag{9}$$

In general, probably the most reasonable and certainly the most convenient assumption about a worker's future wages and hours, if he does not become a participant in a public employment program, is that they will remain unchanged from his present wages and hours.[1] This assumption would appear particularly valid if the public employment program is directed toward low-wage workers. The assumption is algebraically expressed as follows:

$$W_c^0 = W_c^1 = W_c^2 = \ldots = W_c^j = \ldots = W_c^n \tag{10}$$

$$H_c^0 = H_c^1 = H_c^2 = \ldots = H_c^j = \ldots = H_c^n, \tag{11}$$

where W_c^0 and H_c^0 are the worker's wages and hours during the most recent period for which the information is available.

An obvious advantage of this approach is that it enables one to use information from existing data files. Thus, in terms of the Survey of Economic Opportunity, $\bar{W}_c^0$ would be hourly wages during the week previous to the 1967 interview, while H_c^0 would be the product of hours worked during the week previous to the 1967 interview and weeks worked during 1966.

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[1] Almost everyone expects a general upward trend in wages and a downward trend in hours for the economy as a whole. I assume throughout that such trends are equally reflected on both sides of (7) and can therefore be ignored.

It might be argued that the assumption implied by (10) is unrealistic, since earnings are known typically to increase and then decrease as a worker ages. Adjustments for this factor could be made on the basis of an age/earnings profile generated from such cross-sectional data as the Survey of Economic Opportunity. In fact, separate profiles could be generated for workers classified on the basis of race, sex, industry, occupation, and so on. The increase in accuracy from such a refinement, however, does not seem to me to warrant the effort. In any event, the usefulness of the methodology ultimately depends on how accurately the worker's expectations are captured; and it seems plausible that many workers, especially low-wage workers, do not expect substantial changes in their earning capacity as they grow older.

The assumptions contained in (8) through (11) are especially convenient because they permit each side of (7) to be treated as a geometric progression which can be summed into the following expressions:[1]

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[1] For example, define S_c as follows:

$$S_c = \frac{W_c^1 H_c^1}{(1+r)} + \frac{W_c^2 H_c^2}{(1+r)^2} + \ldots + \frac{W_c^n H_c^n}{(1+r)^n} . \qquad (a)$$

Factoring (a) on the basis of (8) and (9) yields

$$S_c = W_c^0 H_c^0 \left[\frac{1}{(1+r)} + \frac{1}{(1+r)^2} + \ldots + \frac{1}{(1+r)^n} \right] . \qquad (b)$$

Dividing (b) by (1+r) yields

$$\frac{S_c}{(1+r)} = W_c^0 H_c^0 \left[\frac{1}{(1+r)^2} + \frac{1}{(1+r)^3} + \ldots + \frac{1}{(1+r)^{n+1}} \right] . \qquad (c)$$

[Footnote continued]

$$W_c^0 H_c^0 \frac{(1+r)^n - 1}{r(1+r)^n} < \frac{W_p^j H_p^1}{(1+r)} + W_p^j H_p^j \left(\frac{(1+r)^{n-1} - 1}{r(1+r)^n} \right) \tag{12}$$

or

$$W_c^0 H_c^0 < W_p^j H_p^1 \left(\frac{r(1+r)^{n-1}}{(1+r)^n - 1} \right) + W_p^j H_p^j \left(\frac{(1+r)^{n-1} - 1}{(1+r)^n - 1} \right) . \tag{13}$$

The inequality contained in (13) is one of the basic tools with which much of the rest of the analysis is built.

Empirical results from an income comparison such as that suggested by (7) and (13) may be sensitive to the choice of the discount rate, r, which is used and to the number of years over which the comparison is conducted, n. It should be noted that as formulated in (13) the importance of r and n is largely dependent on the extent to which H_p^1 and H_p^j differ. For if $H_p^1 = H_p^j$, the comparison implied by (13) is reduced to a much simpler comparison:

$$W_c^0 H_c^0 < W_p^j H_p^j . \tag{14}$$

If, however, $H_p^1 \neq H_p^j$, what values for r and n are appropriate? It seems doubtful that a single most appropriate value for either r or n can be found. For example, there is only limited agreement among

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Subtracting (c) from (b) yields

$$S_c \left(1 - \frac{1}{(1+r)} \right) = W_c^0 H_c^0 \left[\frac{1}{(1+r)} - \frac{1}{(1+r)^{n+1}} \right] \tag{d}$$

or

$$S_c = W_c^0 H_c^0 \left(\frac{(1+r)^n - 1}{r(1+r)^n} \right) . \tag{e}$$

S_p may be found analogously. Substituting S_c and S_p into (7) yields (12).

economists regarding what is an appropriate discount rate to use under a given set of circumstances. This suggests subjecting a range of values to a sensitivity analysis. Weisbrod,[1] for example, suggests that discount "rates of 5 and 10 percent are useful alternatives, since they are near the bottom and the top of the range suggested by theoretical considerations."

A maximum value for n might be the number of years remaining in an individual's working life, estimated by subtracting the individual's current age from his expected retirement age (e.g., 65). If the program contains a "kick-off" provision, limiting the length of time an individual is permitted to participate, this should be used as the maximum value of n. It seems likely that many, if not most, potential applicants will view public employment as a stopgap, rather than a lifetime job. To the extent this is true, the minimum value of n should be relatively small; two or three years might be appropriate.[2]

Estimating W_c^t and W_p^t

It is helpful, at this point, to recall that W_c^t and W_p^t are viewed in net terms and defined as follows:

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[1] Weisbrod, Burton A., "Conceptual Issues in Evaluating Training Programs," Monthly Labor Review, Vol. 89, No. 10 (October 1966), p. 1097.

[2] It can be argued that n should exceed the number of years an individual expects to remain in the program, since his earnings subsequent to leaving the program may differ from what they would have been had he never participated in the program. This is particularly likely to be the case if the program places a strong emphasis on training. Recalling (3), however, it seems conceptually more correct to incorporate such differences into the estimates of W_p^t.

$$W_c^t = \bar{W}_c^t - T_c^t - B_c^t - C_c^t + E_c^t - R_c^t - S_c^t \qquad (3a)$$

$$W_p^t = \bar{W}_p^t - T_p^t - B_p^t - C_p^t + E_p^t + R_p^t - S_p^t \qquad (3b)$$

In the preceeding subsection, I suggested that $\bar{W}_c^t$, the money wage a worker expects to receive in some future period if he does not enter a public employment program, might reasonably be assumed to equal $\bar{W}_c^0$, the worker's most recently recorded money wage. In this subsection, I discuss the remaining wage components.

While money wages are most conveniently thought of in terms of a return for each hour's work, the relation between hours worked and some of the other wage components is less clear. Transportation costs, for example, are unlikely to vary if four rather than eight hours are worked in a particular day, although they will vary with the number of days worked. In addition, many of the wage components are more easily estimated in terms of the difference between their values in the conventional and the public employment sectors than in terms of their absolute values within each sector. For these reasons, it is convenient to modify the inequality contained in (13):[1]

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[1]The modification is accomplished as follows. First it is assumed that the relationship implied by (8) and (10) holds for each wage component as well as for W_p^t and W_c^t. Expressions (3a) and (3b) are then substituted into expression (7) and

$$\frac{-T_c^t - B_c^t - C_c^t + E_c^t - R_c^t - S_c^t}{(1-r)^t} \quad (\text{for } t = 1, 2, \ldots n)$$

is subtracted from both sides of the inequality. Each side of the resulting inequality can then be treated as a geometric progression as described in an earlier footnote.

$$\bar{W}_c^0 H_c^0 < \left| \bar{W}_p^j H_p^1 - T_*^1 - B_*^1 - C_*^1 + E_*^1 - R_*^1 - S_*^1 \right| \frac{r(1+r)^{n-1}}{(1+r)^n - 1}$$

$$+ \left| \bar{W}_p^j H_p^j - T_*^j - B_*^j - C_*^j + E_*^j - R_*^j - S_*^j \right| \frac{(1+r)^{n-1} - 1}{(1+r)^n - 1}, \qquad (15)$$

where

$$T_*^t = T_p^t H_p^t - T_c^t H_c^t, \qquad (16)$$

$$B_*^t = B_p^t H_p^t - B_c^t H_c^t, \qquad (17)$$

$$C_*^t = C_p^t H_p^t - C_c^t H_c^t, \qquad (18)$$

$$E_*^t = E_p^t H_p^t - E_c^t H_c^t, \qquad (19)$$

$$R_*^t = R_p^t H_p^t - R_c^t H_c^t, \qquad (20)$$

and

$$S_*^t = S_p^t H_p^t - S_c^t H_c^t. \qquad (21)$$

Possibly the most difficult part of a simulation to estimate the size of the supply population for a public employment program is to assign reasonable values to the variables within the brackets of expression (15). It is to this that I now turn.

The Public Employment Money Wage Rate ($\bar{W}_p^t$). A public employment program, at least one oriented toward low productivity workers, would probably offer relatively low wages. However, since federal minimum wage legislation tends to establish a national standard, it is doubtful that program wages would fall much below $1.60. An upper boundary for $\bar{W}_p^t$ is more difficult to establish, but unless the program is directed toward temporarily displaced skilled or professional workers, program

stipends very much in excess of $3.00 an hour would seem unlikely.

Taxes (T^t_*). In estimating T^t_*, taxes that must be paid whether the worker joins the program or remains at his present job can be ignored. Taxes that remain for consideration fall into two general categories: $T^t_{*,I}$, tax differences between public employment and conventional jobs that result because the income taxable under existing tax rates would be higher in one job than in the other; $T^t_{*,II}$, taxes that are paid because income earned in public employment is covered by special tax rates not applicable to income received from other sources.

$T^t_{*,I}$ can be estimated from the following expression:

$$T^t_{*,I} = u_I(a_I \bar{W}^t_p H^t_p - \bar{W}^t_c H^t_c), \tag{22}$$

where u_I is the existing tax rate and a_I is the fraction of $\bar{W}^t_p$ which is covered by u_I. If program designers wished to encourage as many persons as possible to join the program, a_I could approach zero. More likely, a_I will be close to one. Otherwise, persons in conventional employment would be treated inequitably. Results from a 1960 study by the Tax Foundation suggest that the value of u_I may be around 0.2.[1]

Since there appears to be a reasonable probability that coverage by the welfare system will soon be extended to most members of the working poor, it may be useful in a simulation to investigate the impact of such a policy on the number of workers desiring to enter public

[1] Allocation of the Tax Burden by Income Class, May 1960, New York. The study concluded that "the total tax burden excluding social insurance is almost exactly proportional to income up to the income level of at least $15,000" and that in 1958 this burden was slightly over 20 percent.

employment. Most likely, welfare to the working poor will take the form of an income guarantee, partially offset by applying a tax rate, v, to earnings. In integrating welfare and public employment, a major issue will be whether earnings from public employment should be treated as taxable or nontaxable. In the simulation, the tax difference under welfare between public employment and a conventional job, $T^t_{*,w}$, may be estimated similarly to $T^t_{*,I}$. Thus,

$$T^t_{*,w} = v(b\bar{W}^t_p H^t_p - \bar{W}^t_c H^t_c), \tag{23}$$

where b is the fraction of $\bar{W}^t_p$ taxed under the welfare program; b will equal 1 if public employment earnings are fully covered by the welfare tax and zero if they are uncovered.

If public employment is viewed principally as an anti-poverty device, policymakers may wish to recoup all or part of the earnings from public employment which bring a family above some specific income level, L, such as the poverty line. This can be accomplished through use of a tax rate, u_{II}, which can only be applied to program earnings. While it is not possible to predict the precise recouping procedure, it will probably operate somewhat as follows:

$$T^t_{*,II} = u_{II}\left| a_{II}(\bar{W}^t_p H^t_p + 0^t) - L \right|, \text{ for } 0^t < L \tag{24a}$$

and

$$T^t_{*,II} = u_{II} a_{II} \bar{W}^t_p H^t_p, \text{ for } 0^t > L, \tag{24b}$$

where 0^t is other family income and a_{II} is the fraction of family income covered by u_{II}.

When two or more members of the same family are eligible to participate in public employment, expression (24) introduces a simultaneity problem. This is because O^t for one family member includes the money earnings of all other family members. These earnings, however, cannot be determined until it is known whether they will participate in public employment. But their decision may depend partially on what the first family member earns from the program, should he decide to participate. Probably the most practical solution to this problem is to assume that family participation decisions are made sequentially, first by the family head, then by the spouse (if any), and finally by other family members in order of age. The family head's decision might be based on the earnings of other family members, assuming they remain with conventional employers. The spouse's decision could then take into account whether or not the family head has decided to participate. A third family member could then incorporate knowledge of both the head and the spouse's decision into his own, and so on.

Transportation Costs (B^t_*). B^t_* incorporates two separate types of costs: $B^t_{*,I}$, the difference between the commuting costs associated with the public employment job and the conventional job, and $B^t_{*,II}$, the cost of a change in residence necessitated by the distance from the worker's home of the nearest opening in public employment. Neither $B^t_{*,I}$ nor $B^t_{*,II}$ can be estimated unless the spatial location of the public employment job slots are known in considerable detail. For example, will the program be limited to a single depressed area such as Appalachia? Will it be mostly in rural or urban areas? Will an attempt be made to match program slots to the geographic distribution of the poor?

Formally, $B^t_{*,I}$ might be estimated as follows:

$$B^t_{*,I} = 2(Q^t_p D^t_p - Q^t_c D^t_c), \tag{25}$$

where Q^t is the cost of the trip between a worker's home and job and D^t is the number of days worked. Conceptually, Q^t should include the opportunity costs associated with the time spent traveling as well as the direct costs of owning and operating an automobile or using public transportation. While it seems likely that public employment will be less accessible to most workers than their present job, and that $B^t_{*,I}$ will exceed zero more often than not, obtaining the data required by expression (25) will probably prove very difficult.

$B^t_{*,II}$ is probably even more difficult to estimate. It seems likely, however, that in most cases the cost of moving one's family simply to participate in a public employment program will be prohibitive. Thus, it may be reasonable to assume that, in general, persons who live too far from a public employment program to commute will not become part of that program's supply population.

Other Work-Related Expenses (C^t_*). While there are exceptions, most work-related expenses associated with public employment seem likely to approximate those associated with alternative sources of employment. The most obvious and important exceptions are transportation costs and day-care costs. Transportation costs were discussed separately. The difference between public and conventional employment in the cost of day care for a working mother, $C^t_{*,DC}$, can be estimated as follows:

$$C^t_{*,DC} = K(DC^t_p H^t_p - DC^t_c H^t_c), \tag{26}$$

where DC^t is the hourly rate per child the mother must pay for day care and K is the number of children for whom care must be provided. Note that $C^t_{*,DC}$ is more likely to vary from zero as H^t_p differs from H^t_c. If day care were provided free to mothers working in public employment (i.e., $DC^t_p = 0$), but not to mothers working elsewhere, $C^t_{*,DC} < 0$. Thus the policy would produce an incentive for working mothers to join public employment.

The strength of this incentive would depend on the value of DC^t_c. Since the cost of day care varies by geographic location and by the quality of service provided, the precise value of DC^t_c is not obvious. One set of estimates which might be used suggests that the cost of day care is probably in the neighborhood of 50 cents per hour per child, although "optimal day care such as that provided by the experimental centers" may be as high as $1.50 per hour per child.[1]

Human Capital (E^t_*). Unless the public employment program, in terms of money, time and orientation, is strongly committed to training, or there is a large difference between H^t_c and H^t_p, it is probably not unreasonable to assume that $E^t_* \approx 0$.[2] If there is a strong emphasis on training, E^t_* will approximately equal the present value of the stream of economic benefits a worker receives from one year of training. If the public employment program is new, these gains cannot be directly estimated. They might, however, be roughly calculated on the basis of the

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[1]The President's Commission on Income Maintenance Programs, Background Papers, 1970, Chapter 5.3 on "Child Rearing," p. 127.

[2]This assumption may be somewhat invalid if the program advertises itself as a source of useful training and convinces prospective applicants that they will receive more training than is, in fact, offered. However, this sort of effect probably cannot be measured.

results from a cost-benefit analysis of some other manpower program which provided training similar to that envisioned for the public employment program.[1]

To illustrate, assume that a study of an appropriate training program indicated that six month's of training resulted in an income during the first post-training year that is $1,000 higher than it would have been had no training taken place. To calculate the present value of the private return from training, it is conventionall, assumed that the $1,000 income benefit will continue to be received annually for the remainder of the former trainee's working life. To calculate E^t_*, however, two additional steps are necessary. First, it must be assumed that if a potential candidate for public employment received similar training, he would receive similar benefits. Second, it is necessary to determine what the return would have been from a full year of training rather than from only six months. If the study provides no information on the relationship between time in the program and program benefits, the most obvious procedure is to simply multiply $1,000 by two. It must be recognized, however, that if there are diminishing returns to training, this procedure will produce an overestimate.

Risk (R^t_*). Since there is little empirical work on risk premiums in various occupations and industries, measurement of R^t_* is difficult.

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[1] A rather complete list of training program cost-benefit studies is found in W. D. Wood and H. F. Campbell, Cost-Benefit Analysis and the Economics of Investment in Human Resources: An Annotated Bibliography, Industrial Relations Centre, Queen's University, Kingston, Ontario, 1970.

However, some feeling for the likely direction and order of magnitude R_*^t is possible. At first glance it seems apparent that public employment would be less risky than conventional employment, particularly for workers leaving low-paying jobs. This suggests that $R_*^t < 0$. Some further reflection suggests, however, that the size of R_*^t may be very small. Funding shifts between manpower programs have been frequent over the last decade and have largely depended on the vagaries of fashion. Furthermore, it is very likely that the funding available for public employment will be directly related to the size of the unemployment rate; this could make jobs in public employment as subject to the business cycle as those with conventional employers.[1]

Status (S_*^t). I know of no empirical analysis of the market value of the status associated with various occupations or industries. Thus, S_*^t is difficult to estimate. It seems probable, however, that if the public employment program is oriented toward low-productivity workers, both public employment and alternative opportunities will be held in relatively low esteem and S_*^t will be very small. If on the other hand there is a serious intent to provide employment for displaced skilled and professional workers, the value of S_*^t will be positive and may be rather large.

The Hours Comparison

The methodology developed in this paper rests on the supposition that an individual's decision on whether to participate in public

[1] In fact, a counter-cyclical public employment program would increase the value of R_p^t but reduce the value of R_c^t.

employment will be based on a comparison between the program and other available opportunities. Until now the emphasis has been on a single aspect of the comparison, that based on income. Equally important is the comparison of hours worked or put alternatively, of leisure foregone.

The hours comparison is, in and of itself, very straightforward. Everything else being equal, the superior job is the one requiring less hours of work. Complexities arise from situations where hours and income can be traded off; when one job provides a higher income but also requires a greater number of hours of work.

This choice between income and leisure for an individual worker is analyzed in Figure 1. The line XPZ represents the budget constraint associated with the worker's best alternative to public employment. OX is the worker's total stock of time. XD is his labor-offer curve, while I_1I_1 is a member of his family of indifference curves. Thus if public employment was not an available alternative, the worker would be in equilibrium at point P. He would choose to work XH hours and he would earn OA dollars.

Point P is on I_1I_1, the highest indifference curve the worker can obtain within the limits imposed by YPZ, the conventional sector budget constraint. If public employment permits the worker to reach a higher indifference than I_1I_1, he will, of course, prefer the program to conventional employment. But under what circumstances will a public employment program allow the worker to exceed I_1I_1? To analyze this issue, I investigate two contrasting public employment programs: the first

places no restrictions on hours worked while the second requires a precise number of hours of work during each period.

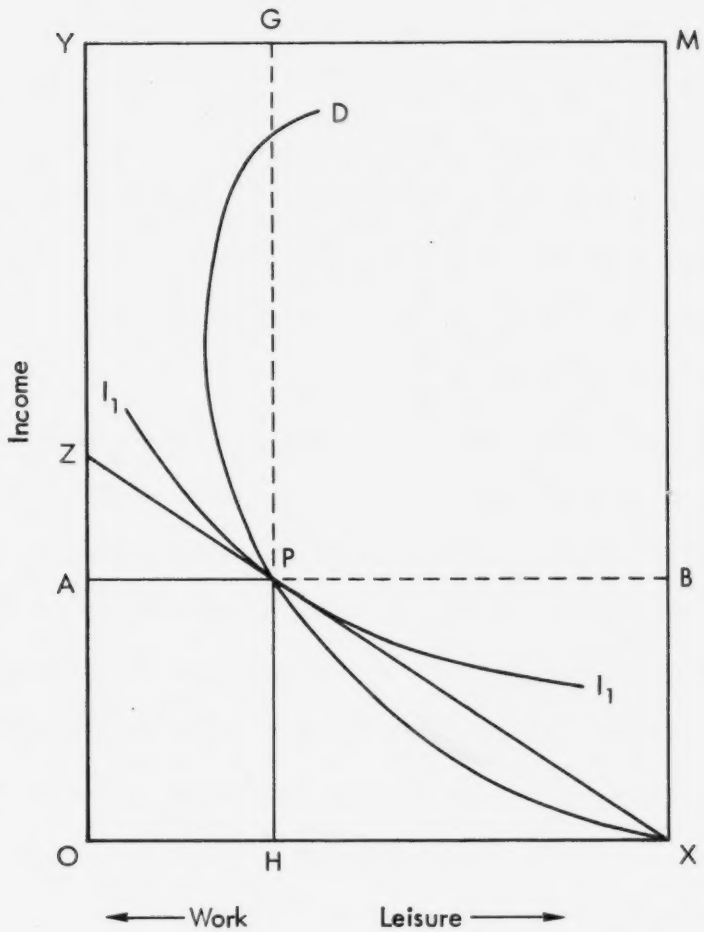

Figure 1

If a worker is free to choose between income and leisure in the public employment sector, as well as in the conventional sector, he will than select the sector offering the highest wage rate. In terms of the diagram this will be the job associated with the more negatively sloped budget line. For the more negatively sloped the budget line, the higher is the point of intersection along XPD, the worker's labor-offer curve. With no constraints on hours, all that is necessary to determine a worker's preference between public employment and conventional employment is to determine which, at the same number of hours worked, would provide him with a higher income. Thus, evaluating expression (13) at $H_c^0 = H_p^1 = H_p^i$, it is seen that a worker will join a public employment program whenever $W_c^0 < W_p^j$.

When a public employment program requires a certain number of hours of work, a worker's choice between the program and conventional employment is more complex. In this case, the program budget constraint is diagramatically represented by a single point rather than by a line. Unless the program budget point just happens to be on the worker's offer curve, the worker selecting the program will be in disequilibrium.

To determine whether a worker will choose the program, one must ascertain whether the program budget point is above or below I_1I_1. If I_1I_1 is an indifference curve with the normal properties, any program budget point which falls below the conventional sector budget line, XPZ, will clearly also be below I_1I_1. On the other hand, a program budget point which is above and to the right of point P will be above I_1I_1. Thus, if $\bar{H}_p^t$ is the number of hours required by the program, a worker will select public employment over his next best alternative if

$$W_c^0 H_c^0 < W_p^{j-1} \bar{H}_p^{j-1} \left(\frac{r(1+r)^{n-1}}{(1+r)^n - 1} \right) + W_p^{j-j} \bar{H}_p^{j-j} \left(\frac{(1+r)^{n-1} - 1}{(1+r)^n - 1} \right) \tag{27}$$

and

$$H_c^0 > \bar{H}_p^1 \left(\frac{r(1+r)^{n-1}}{(1+r)^n - 1} \right) + \bar{H}_p^j \left(\frac{(1+r)^{n-1} - 1}{(1+r)^n - 1} \right) . \tag{28}$$

He will <u>not</u> choose public employment if

$$W_c^0 > W_p^j . \tag{29}$$

In terms of Figure 1, expressions (27), (28) and (29) delineate two areas: PGMB and XZO. If the program budget point falls within PGMB or XZO, the worker can be regarded as, respectively, either a <u>definite</u> participant or a <u>definite</u> nonparticipant in public employment. But if the program budget point is within the remaining two areas, XPB or PGYA, the worker may only be regarded as a <u>possible</u> participant.

This, at least, is the situation in the absence of information about the shape of the worker's labor-supply function. If such information is available, the region of indeterminancy within PGYA can be limited to that part of the rectangle to the left of PD; for any program budget point to the right of PD and above APB must also be above $I_1 I_1$. Thus, where an individual worker's labor supply function is

$$H_s = f(W), \tag{30}$$

he will wish to participate in public employment whenever the inequality in expression (27) is satisfied <u>and</u>

$$f(W_p^j) > \bar{H}_p^1 \left(\frac{r(1+r)^{n-1}}{(1+r)^n - 1} \right) + \bar{H}_p^j \left(\frac{(1+r)^{n-1} - 1}{(1+r)^n - 1} \right). \quad (31)$$

To summarize, then, an individual may be classified as a definite participant when the conditions in expressions (27) and either expression (28) or (31) are met, as a definite nonparticipant when condition (29) is met, and as a possible participant when none of the preceding sets of conditions are satisfied. In a simulation, the potential public employment supply population should be estimated with possible participants alternatively included and excluded. This will provide a range into which the actual number of program participants should fall.

Before expression (31) is used in a simulation, the functional form and parameters of expression (30) must be specified. To do this, the approach taken by Michael C. Barth appears useful.[1] Barth assumed a constant elasticity labor supply function and used the following log form:

$$\ln H_s = b_1 + b_2 \ln \bar{W}. \quad (32)$$

Operationally, this form is convenient because the slope of the function, b_2, is equivalent to the wage rate elasticity of supply. On the basis of a survey of the relevant literature and certain other considerations, Barth concluded that a reasonable range of values for b_2 for low-wage working male heads of households might be between zero

[1] Michael C. Barth, "Cost, Coverage and Antipoverty Effect of a Per-Hour Wage Subsidy," unpublished thesis, The City University of New York, 1971, Chapter VI.

and 0.2, with perhaps 0.5 providing an extreme upper bound. He further suggested that, while it is not unreasonable to assume that the supply schedule is positive throughout the lower wage range, there is some evidence that suggests the curve bends backward at around $2 an hour. Barth approximated such a curve "by employing a linear function with a change-of-slope kink at the wage rate at which the income effect is presumed to dominate the substitution effect"[1] (i.e., $2 an hour). On the basis of existing evidence, it was assumed that $b_2 = -0.1$ above the kink. Once a value for b_2 is assumed, b_1 can be found by substituting each worker's value for $\bar{W}_c^0$ and H_c^0 into expression (32).

The analysis in this section has treated two contrasting types of public employment programs: the case where participants have complete control over the hours they work and the case where they have no control. Operationally, both situations are probably somewhat unrealistic. For example, program managers can limit the maximum number of annual hours worked on public employment by requiring unpaid "vacations" and eight-hour days, but within these limits program participants can exercise some discretion through absenteeism or, in the extreme, by terminating from the program and rejoining at some later date.[2]

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[1] Ibid, p. 108.

[2] Program managers can, of course, further limit the discretion of participants by "firing" individuals with an excessive number of absences or by making it difficult for those who voluntarily terminate to rejoin the program. Such measures, however, probably would be only partially successful.

It should not be too difficult to adopt the simulation to these more complex circumstances. If the maximum limit program managers impose on program hours exceeds H_c^0 and program participants can freely determine their own hours within these limits, the situation is analogous to a public employment program which places no constraints on hours. Thus, a worker would desire to participate in the program whenever $W_c^0 < W_p^j$. If on the other hand the maximum limit on program hours was less than H_c^0, the maximum limit could be treated the same as a program requirement to work a precise number of hours. In this case, the conditions which determine whether or not a worker would like to participate in the program are embodied in expressions (27), (28), (29), and (31).

One of the potentially more important restrictions which could be placed on program hours is to require a waiting period during which a program applicant could not engage in market work. While this requirement would ostensively be aimed at limiting the program to the long-term involuntary unemployed, administratively it probably would be impossible to distinguish between those who wanted work with conventional employers but could not find it and those who were not working in order to meet the requirements imposed by the waiting period.

The primary impact of a waiting period provision should be to discourage entry into public employment on the part of those persons who at the wage offered by the program prefer to work more hours than the restriction permits. It would be useful in a simulation to see how sensitive the public employment supply population is to waiting periods of various lengths. This could easily be tested by allowing the length of the waiting period, m, to assume different values and by calculating required program

hours during the first year, $\bar{H}_p^1$, as follows:

$$\bar{H}_p^1 = \bar{H}_p^j - m. \tag{33}$$

IV. THE UNEMPLOYED

The income and hours comparisons developed in the last section were premised on the assumption that in the absence of public employment all persons would be in equilibrium. For most persons, this assumption is probably the most defensible which can be made; there are little or no data to suggest otherwise. There are, however, a substantial minority of persons who have indicated on surveys that they would prefer to work either more or less hours than they presently work. These individuals are conveniently placed into three categories. First are the measured unemployed: persons who are not working but are actively looking for work. Second are the hidden unemployed: persons who are not working or actively looking for work, but who nevertheless want to work. Third, are part-time workers who prefer full-time work or full-time workers who prefer part-time work. During the course of a single year an individual might fall into one or more of these categories and, in addition, be in equilibrium during part of the year. Ideally, the researcher who wished to estimate the supply population for a public employment program would obtain full information on how many annual hours an individual wished to work, as well as the hours actually worked. This concept--the annual hours a person would like to work should he remain in the conventional sector--will be referred to as "desired hours." Should a person be in equilibrium throughout the entire year, desired hours, $*H_c^0$, will equal actual hours, H_c^0.

Survey respondents who indicate that $*H_c^0 \neq H_c^0$ presumably have some implicit wage rate in mind when they think in terms of the hours they would like to work; otherwise, the notion of desired hours is analytically

empty. The value of this "expected" wage, $*W_c^0$, however, is not always obvious to the survey user. One possibility is that persons who are in an hours disequilibrium expect $*W_c^0$ more or less to approximate W_c^0, the wage rate received for hours actually worked. If this is so, many of these individuals are not being very realistic. For example, the market value of workers tends to deteriorate while they are unemployed. On the other hand, workers who switch from part-time to full-time work may very well be able to obtain a higher wage rate. A more practical difficulty with using actual wages as a surrogate for expected wages is that, for many of the unemployed, W_c^0 is not available. The most obvious example, although there are others, is a person who had no earnings during the entire period covered by the survey but nevertheless indicated a desire to work during at least part of this period.

One alternative to W_c^0 as a proxy for $*W_c^0$ is wage rates which are imputed on the basis of the wages of those who are in hours equilibrium.[1] For example, if a part-year worker wishes to work year-round, it might be reasonable for him to expect wages similar to year-round workers with whom he shares characteristics known to affect earnings potential. By assembling data on the demographic and economic characteristics of persons who worked year-round, one can infer wage rates for persons possessing similar characteristics who wished to work year-round but could not.[2]

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[1] For a number of reasons actual money wage rates may also not be available for some survey respondents for whom $*H_c^0 = H_c^0$. Wage rate estimates for these persons can also be obtained through imputation.

[2] Imputed wages have been used in several recent labor supply studies. For a rather thorough discussion of how they might be estimated see Barth, op.cit., Appendix B. For a critique of their use see Irwin Garfinkel, On Estimating the Labor Supply Effects of a Negative Income Tax, unpublished paper, Institute for Research on Poverty, University of Wisconsin, 1971.

However, the fact that one group of individuals worked year-round while the other did not is itself prima facie evidence of important differences between the two groups. An adjustment to the imputed wage needs to be made to account for this difference. An estimate of this adjustment might be obtained from a longitudinal data file. For example, the wage rates of persons who did not work year-round during one year but did the next could be compared to those for similar persons who worked year-round during both years.

The value of $*H_c^0$, like that of $*W_c^0$, can only be approximated in practice. Questions which attempt to elicit the number of hours people desire to work are by nature hypothetical and therefore highly suspect. Moreover, no survey with which I am familiar asks all the necessary questions. This may be illustrated by examining what the 1967 Survey of Economic Opportunity (SEO)--a relatively complete data base--can and cannot provide. For the year 1966 the following types of information about desired hours may be obtained: (1) the number of weeks of measured unemployment; (2) whether persons who "usually" worked part-time wanted to work full-time; (3) whether persons who stayed out of the labor force for the entire year did so because they thought they could not find work. While this is very helpful information, there remain important questions which cannot be answered. For example, if a person is laid off from his job at the beginning of the year, actively looks for work during the first part of the year and withdraws from the labor force during the last part of the year, there is no way of knowing from the SEO how many weeks he actually wished to work. Similarly, one is uncertain how many women, who were out of the labor force during all or part of the year because

of "home responsibilities," might be willing to work if inexpensive or free day care were made available.

To try to cast some light on such issues, it might be useful to supplement the major data file being used in the simulation, such as the Survey of Economic Opportunity, with other sources of information. For example, the Bureau of Labor Statistics (BLS) publishes quarterly data on persons who are out of the labor force at the time they are interviewed.[1] Among the information obtained are the number of persons who claim they want a job although they are not actively looking for work. These persons are classified as follows: those prevented from looking for work because of school, illness or disability, or home responsibility; those who feel any search for a job would be futile--a measure of the number of "discouraged workers"; and a residual category of those who want work but are out of the labor force for other reasons.

There are a number of alternative assumptions which might be made in using these data to supplement the Survey of Economic Opportunity. Only a few illustrative suggestions will be made here. The first concerns a possible technique for estimating the number of persons in the labor force part of the year who might remain in the labor force for the entire year if they thought work was available. The first step is to subtract, from the published BLS annual average estimate of the number of discouraged workers at a single point in time, an estimate obtained from the SEO of the number of discouraged workers who remained out of the labor force for the entire year. This provides an estimate of the

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[1] See the December 1969 issue of Employment and Earnings (Vol. 16, No. 6), U.S. Department of Labor, Bureau of Labor Statistics.

average number of discouraged workers at a single point in time who actively participated in the labor force during part of the year. Such persons might be referred to as "part-year discouraged workers," while individuals who stay out of the labor force for the entire year because they thought no work was available can be called "full-year discouraged workers." Full-year discouraged workers in the SEO sample can be directly identified, but part-year discouraged workers cannot. To overcome this difficulty, the estimate of the total number of part-year discouraged workers can be divided by the total number of part-year workers.[1] The resulting fraction can be interpreted as a maximum estimate of the probability that a given part-year worker dropped out of the labor force for the remainder of the year because he thought no jobs were available. This probability measure can be used to randomly designate part-year workers within the SEO sample as "part-year discouraged workers." As a maximum estimate of $*H_c^0$, it might be assumed that individuals identified or designated as discouraged workers would work year-round (50 weeks a year), if they thought they could obtain a job at $*W_c^0$.

In estimating the supply population for public employment programs which provide day care, it is important to estimate the desired hours of women who remain out of the labor force for all or part of the year because of "home responsibility." The fraction of these women who claim at a given point in time to "want a job now" can be obtained directly from the BLS report on persons not in the labor force. This fraction

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[1] While an estimate of part-year workers can be obtained from the SEO file, it might be more consistent with the numerator of the fraction to obtain the denominator from the 1968 BLS Special Labor Force Report, No. 91, "Work Experience of the Population, 1966."

may be interpreted as a maximum estimate of the probability that a woman out of the labor force because of home responsibility would take a job if child care were provided. On the basis of this probability estimate, women within the SEO sample who remained out of the labor force for all or part of the year, because of home responsibility, can be randomly designated as probable labor force entrants were day care provided.

Even if sufficient questions are asked in a survey so that $*H_c^0$ can be reasonably approximated, considerable uncertainty must remain. The necessarily hypothetical nature of the concept of desired hours has already been mentioned. To test the sensitivity of the results to the broadly defined version of $*H_c^0$ which has been emphasized in this section and which incorporates several very hypothetical components, it may be useful to repeat the simulation with a narrow version which excludes the more hypothetical elements. One very narrow version of $*H_c^0$ can be calculated from the 1967 SEO file by multiplying the number of weeks spent working or looking for work in 1966 times the number of hours worked during the week preceding the survey interview.

Another cause of uncertainty revolves around the future expectations of those for whom $*H_c^0 \neq H_c^0$. What are these peoples' expectations that they will be able to work the number of hours they wish, should they remain within the conventional sector? For the higher the probability an individual associates with obtaining hours equilibrium within the conventional sector, the less he is likely to want to join a public employment program. Public employment becomes relatively more attractive to the individual in disequilibrium, the greater his expectation that,

if he remains in the conventional sector, he will have to continue working at H_c^0 hours. This uncertainty about how the future is perceived suggests that the supply population for public employment be estimated by alternatively allowing $*H_c^0$ and H_c^0 to represent future hours within the conventional sector. These alternative procedures will produce minimum and maximum estimates, respectively.

If it is assumed that the worker expects to be in equilibrium, that is, if in future years he anticipates employment at $*H_c^0$ hours, then the hours and income comparisons are almost identical to those described in earlier sections and summarized by expressions (27), (28), (29), and (31). The major difference is that if $*H_c^0$ and $*W_c^0$ do <u>not</u> equal H_c^0 and W_c^0, respectively, the former should be used in preference to the latter.

If it is assumed that workers expect to remain in disequilibrium at H_c^0 hours as long as they remain within the conventional sector, the hours and income comparisons must be modified somewhat. These changes are analyzed in Figure 2. Figure 2 differs from Figure 1 in two major respects. First, the slope of the conventional sector budget line is equal to $*W_c^0$ rather than W_c^0. Second, while the worker would choose to work X^*H hours, he expects to be constrained to XL hours. Thus, instead of being in equilibrium at *P along indifference curve I_1I_1, he anticipates that, should he stay in the conventional sector, he will be in disequilibrium at point Q along the lower indifference curve I_2I_2.

Now if public employment allows the worker to reach a higher indifference curve than I_2I_2, he will wish to join the program. To investigate the circumstances under which this test will be met, I

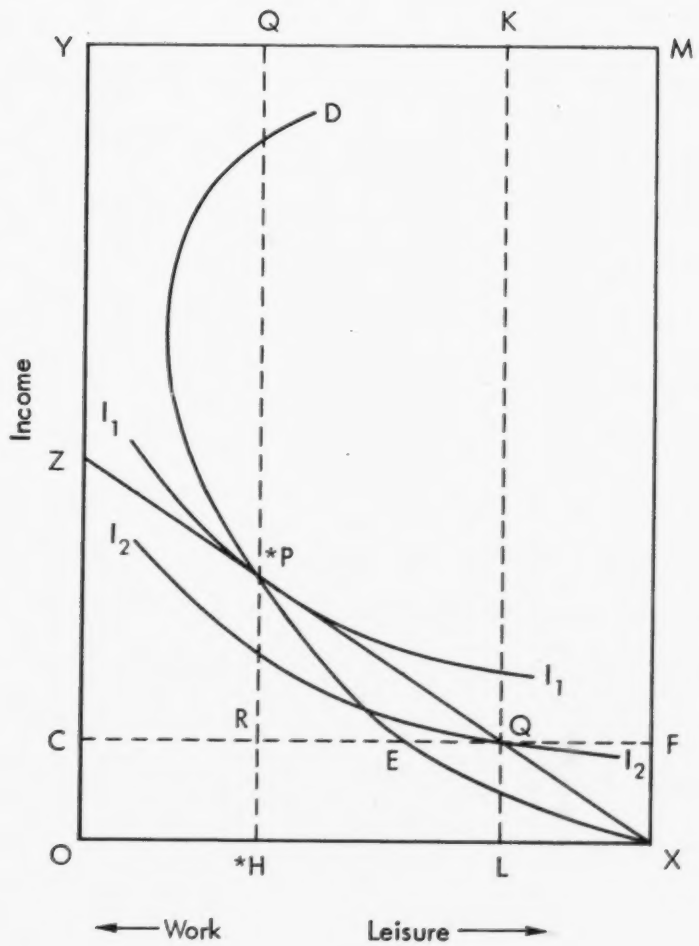

Figure 2

again first analyze a program which places no restrictions on hours and then turn to a program which requires a precise number of annual hours.

If a public employment program allows a worker to choose his hours, the worker will select the point at which the program budget line intersects XE^*PD, his labor-offer curve. It should be obvious from Figure 2 that, if this point is on the segment of XE^*PD above P^*, public employment

is a superior alternative to conventional employment. It is also clear that if the public employment budget line intersects XE^*PD below E, the program is inferior to conventional employment. If the program budget line intersects the segment P^*E of the labor-offer curve, the worker's choice between the two alternatives is indeterminate. These results may be summarized algebraically: A worker will wish to participate in public employment if $W_p^j > {}^*W_c^0$; he will not wish to participate if $W_p^j H_p^j < {}^*W_c^0 H_c^0$. If neither condition is met, the results are indeterminate.

When public employment requires a precise number of hours from a worker, the program budget constraint is diagrammatically represented by a point. Unless this point falls on his labor-offer curve, the worker who selects the program will be in disequilibrium. But point Q also represents a disequilibrium situation. The worker's choice between these two disequilibrium situations will nevertheless depend upon which allows him to obtain the highest indifference curve. To determine this, it is useful to divide I_2I_2 into three segments and place boundaries around each segment. For example, since I_2I_2 passes below point P^* and through point Q, the segment of I_2I_2 to the right of Q is bounded by the triangular area QFX. For similar reasons, the segment to the left of Q but to the right of the line segment P^*R is bounded by the triangular area P^*RQ. The third segment of I_2I_2 is bounded by the rectangle Y^*GRC, but is also limited to that part of the rectangle which is to the left of P^*D. These three areas which bound I_2I_2 represent regions of indetermancy. A worker will wish to join public employment if the program budget point is located above and to the right of these regions (i.e., within areas MFQ^*PG or MFQ^*PD); he

will not select public employment if the program budget point is below and to the left of these regions (i.e., within the area XQCO).

These results may be restated algebraically. A worker will select public employment over his next best alternative if

$$*W_c^0 H_c^0 < W_p^j \bar{H}_p^1 \left(\frac{r(1+r)^{n-1}}{(1+r)^n-1}\right) + W_H^j \bar{H}_p^j \left(\frac{(1+r)^{n-1}-1}{(1+r)^n-1}\right) \qquad (27^*)$$

and

$$*W_c^0 < W_p^j \qquad (34)$$

and either

$$*H_c^0 > \bar{H}_p^1 \left(\frac{r(1+r)^{n-1}}{(1+r)^n-1}\right) + \bar{H}_p^j \left(\frac{(1+r)^{n-1}-1}{(1+r)^n-1}\right) \qquad (28^*)$$

or

$$f(W_p^j) > \bar{H}_p^1 \left(\frac{r(1+r)^{n-1}}{(1+r)^n-1}\right) + \bar{H}_p^j \left(\frac{(1+r)^{n-1}-1}{(1+r)^n-1}\right). \qquad (31)$$

The worker will be a definite nonparticipant in public employment if neither (27^*) nor (34) are satisfied. If a worker's choice between conventional and public employment is indeterminate (that is, if he cannot be classified as either a definite participant or definite nonparticipant), he can only be classified as a possible participant.

V. NON-WORKERS

There is one remaining and I suspect quite minor source of applicants for public employment which has not yet been analyzed. These are persons whose potential conventional sector wage, $*W_c^0$, is so low that it fails to draw them into the labor force. This so-called "corner solution" is illustrated in Figure 3, where XZ is the conventional sector budget constraint facing the non-worker, XD is his labor-offer curve, and XI is a member of his family of indifference curves.

To analyze the influence of public employment on such non-workers, I once more investigate two programs: the first frees the worker to choose the hours he wishes to work, while the second imposes hours restrictions. The non-worker will wish to participate in the first program if W_p^j is sufficiently high, so that the program budget constraint intersects his labor-offer curve.

It was pointed out earlier that the budget constraint for a program requiring a precise number of hours is diagramatically represented by a point. An individual's choice between such a program and non-participation in the labor force may be analyzed by drawing a line (not shown) which begins at X, passes through the program budget point, and ends at OY. The non-worker will <u>definitely</u> wish to participate in the program if this line intersects the labor-offer curve <u>and</u> the program budget point is to the right of XD. If the line intersects the XD, <u>but</u> the budget point is to the left of the labor-offer curve, the non-worker will <u>possibly</u> wish to participate. And if the line fails to intersect XD, the non-worker will <u>definitely not</u> participate in the program.

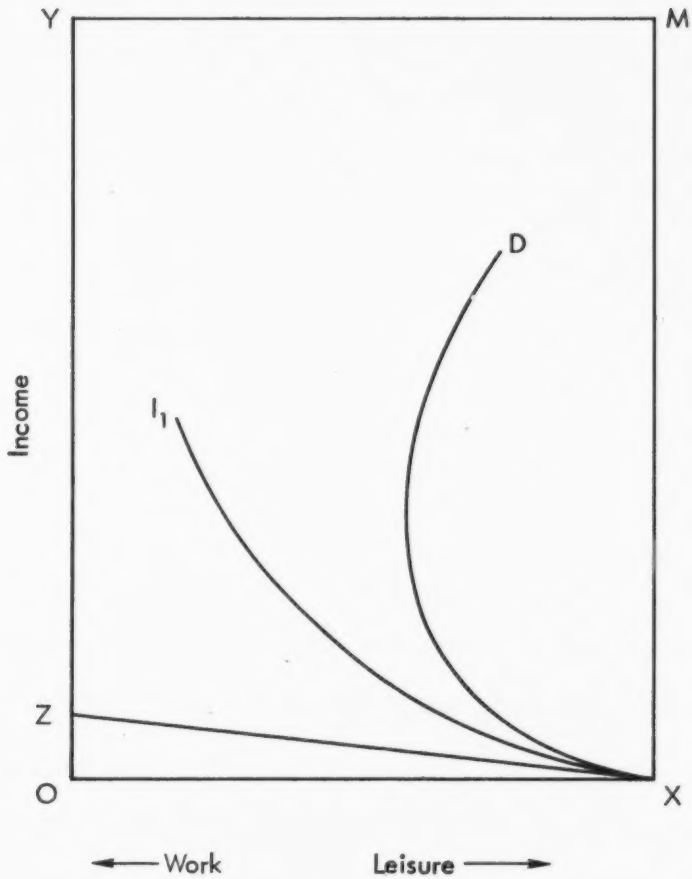

Figure 3

Thus, to determine whether a non-worker will participate in a public employment program with either flexible or fixed hours, the first step is to see if W_p^j is sufficiently high to induce him to enter the labor force. If the non-worker is willing to join the labor force but program hours are fixed, he can be classified as a <u>definite</u> program participant whenever the inequality in expression (31) is satisfied and as a <u>possible</u> participant whenever it is not. As suggested earlier, to use expression (31) the functional form and parameters of expression (30) must be specified. Expression (32) provided one way of doing this.

This expression and its associate range of wage rate elasticities, however, are only applicable if a decision has already been made to enter the labor force. As already indicated, the probability, P, that public employment will result in such a decision by a non-worker depends on the relative size of conventional and public employment sector wages. Thus,

$$P = f(W_p^j - {}^*W_c^0) \tag{35}$$

where $P = 0$, for $W_p^j \leq {}^*W_c^0$ and $P \geq 0$, for $W_p^j > W_c^0$. An estimate of P can be used to randomly designate observations of non-workers in the sample as potential labor force participants and non-participants.

While estimates do exist of the relation between wage rates and the conditional probability of participation in the labor force,[1] they do not seem to me to be notably reliable. Since separate estimates are made for a number of different demographic groups, only a few illustrative estimates are noted here. Kalacheck and Raines found that the probability that a white female, between the ages of 24 and 61 years, will participate in the labor force increases by .00288 for every penny increase

[1]Edward D. Kalachek and Frederic Q. Raines, "Labor Supply of Lower Income Workers and the Negative Income Tax" in Technical Reports of the President's Commission on Income Maintenance Programs (Washington, D. C.: U.S. Government Printing Office, 1970) and Michael J. Boskin, The Economics of the Labor Supply, November 1970, Memorandum No. 110, Stanford University Research Center in Economic Growth. The usefulness of the Boskin estimates are open to question since he allowed his "participation" variable to take a value of zero for persons who were in the labor force for up to half a year. It seems conceptually more correct only to allow the variable to take a value of zero, if the person did not participate in the labor force at all during the year.

in her potential wage rate. Similarly, they found that a wage change from $2.00 to $2.01 would increase the probability that a white man between 24 and 61 would participate in the labor force by .00064. Boskin, on the other hand, found that the influence of wages on the participation decisions of prime age white husbands and wives does not statistically differ from zero.

VI. WAGE RESPONSE BY CONVENTIONAL EMPLOYERS

Within the conventional employment sector, the introduction of a public employment program should cause an upward shift in the supply curve for the class of labor, most likely the low skilled, from which program participants are drawn. Unless the conventional sector demand curve for low skilled labor is perfectly elastic, employers will increase the wages they offer this class of employee. The larger this wage response, the fewer will be the number of persons ultimately willing to work in the public employment sector.

While the interaction of these supply and demand factors will more or less take place simultaneously, from the perspective of simulating the supply of public employment applicants it is more useful to view the process as a series of iterative steps. The appropriate first step in the simulation would be to estimate the supply of man hours lost to the conventional sector as if there was no wage response on the part of conventional employers. The second step would involve estimating the wage response to this loss of hours,[1] while the third step would calculate how many hours were regained by the conventional sector as a result of the upward adjustment in wages. This movement of labor back into the conventional sector would cause wages to be revised somewhat downward, but by less than the original upward adjustment. This, in turn, will stimulate some flow of labor back toward the public employment

[1] In this context, it is useful to emphasize that the initial loss of labor will be determined by whichever of the following two quantities is smaller: the number of persons who desire to enter public employment prior to any employer wage response; the number of available program slots. (See expressions (4a) and (4b).)

sector, and so on. The simulation should continue with this step by step process until considerable convergence has occurred.

The magnitude of the employer wage response to a given shift in the labor supply is captured by the hours elasticity of demand. Unfortunately, there is little empirical evidence on the value of this parameter. From his survey of the sparse evidence which does exist, Michael Barth concluded that a reasonable range of values for the wage elasticity of demand for low skilled workers is from -0.4 to -2.5.[1] Since the wage elasticity of demand is the reciprocal of the hours elasticity of demand, Barth's estimates imply that the appropriate range of values for the latter is also -0.4 to-2.5.[2] These estimates should be considered very "soft." Nevertheless, taken at face value, they infer that a one percent reduction in the low-skilled man hours available to conventional employers would result in a wage increase of from 0.4 to 2.5 percent.

To use these demand elasticity estimates in a simulation, it is necessary to estimate the percentage shift in labor from the conventional sector, as well as the absolute shift. Conceptually, this should be estimated by dividing the potential hours of labor lost to conventional employers as a consequence of the shift in labor supply by the total hours of low-skilled labor offered to conventional employers prior to the shift. Operationally, it is not entirely clear how the denominator of this function should be defined. One alternative is to sum the potential hours of all individuals for whom $\bar{W}_c^0$ falls below some maximum

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[1] Barth, op.cit., pp. 112-116.

[2] That is, the reciprocal of -0.4 is -2.5, while the reciprocal of -2.5 is -0.4.

level, such as $2 or $3. A second alternative might be to sum the hours of all persons associated with the low-skill occupational groups, such as service workers and farm and non-farm laborers.